Northern Long-eared Bat Project

At Santee Coastal Reserve and Wildlife Management Area

and The Nature Conservancy Washo Reserve

2018 – 2019 General Report

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Summary

A total of eight Northern long-eared bats (*Myotis septentrionalis*, or MYSE) have been captured during the summers of 2018 and 2019 at Santee Coastal Reserve and Wildlife Management Area (WMA) and Washo Reserve in the South Carolina coastal plain. These include 2 subadults (1 male, 1 female), 3 adult males, and 3 pregnant females. The subadults, 1 adult male, and 2 pregnant females were fitted with radio transmitters and tracked to day roost sites. A sweetgum (*Liquidambar styraciflua*) cavity within 300 feet of the capture location was used by the adult male for at least 5 days. All females roosted under bark of live, mature longleaf pine (*Pinus palustris*) within 150 feet of a road, in uniform aged stands approx. 85 years old undergoing frequent fire (1 to 5 years) and managed for local populations of endangered red-cockaded woodpeckers (*Leuconotopicus borealis*). Average female roost tree (n = 10) characteristics were 30% canopy closure, 14-inch DBH, 30% exfoliating bark, and approximately 58 feet tall. All females were found to switch roosts daily, and distances between the previous roost varied between 5 and 1,200 feet. Only one roost tree was used twice. Females generally roosted alone, and no maternity colonies were found. Capture locations for females were about 1 mile away from their day roosts, and capture site habitat varied greatly from that of day roosts. Females were tracked to longleaf pine roosts from captures sites in either a mixed hardwood pond area (subadult female) or closed canopy near-maritime forest (both pregnant females). We suspect capture sites were primarily foraging areas. We estimate the pup season for this population to be between late April and early May, approximately one month earlier than that outlined in the current 4(d) rule. Swabbing for the fungus that causes White-nose Syndrome tested was conducted both years, and results were negative for the fungus.

Introduction

The South Carolina Department of Natural Resources, through funding from State Wildlife Grants and the US Fish and Wildlife Service White-nose Syndrome Grants to States, continues to seek location and roost information for the federally threatened Northern long-eared bat on the South Carolina coastal plain. The Northern long-eared bat is a federally threatened species due to 90-100% mortality and dramatic population declines from White-nose Syndrome (WNS). This species was only recently discovered on the SC coastal plain in 2016, far from the southern end of its range in the Upstate. Northern long-eared bats were first discovered on the coast in November 2016 at Palmetto Bluff Conservancy in Beaufort County with one adult male and one juvenile female. At Francis Marion National Forest in 2017, they were found breeding in Charleston and Berkeley counties. By 2018, a total of 20 individuals had been captured at Francis Marion National Forest and included all sex and age classes except pregnant females. At Palmetto Bluff Conservancy in 2018, Clemson graduate student Kyle Shute captured one adult male. This year, the same male was recaptured, along with two additional adult males, providing an unprecedented opportunity to collect multiyear coastal summer roost information with the same individual. Including SCDNR's contribution outlined in this report, a total of 33 Northern long-eared bats have been netted in the SC coastal plain to date, thanks to the people and organizations working to understand this species' distribution and habitat use.

However, much remains to be understood about these populations, as evidenced by the fact that it was only this year that pregnant MYSE were captured for the first time on the South Carolina coast. This discovery by SCDNR at Santee Coastal Reserve and WMA and Washo Reserve is

what is described in this report.

Santee Coastal Reserve and WMA is 24,000 acres encompassing the freshwater cypress swamp of The Nature Conservancy's 1,040-acre Washo Reserve, diverse uplands including mature longleaf pine stands, Carolina Bays, and mixed hardwoods; and freshwater, brackish and tidal wetlands and agricultural fields. Within and amongst these unique habitat types, we captured MYSE near freshwater marsh in closed canopy near-maritime forests with a loblolly pine-hardwood component and tracked them to their roosts in longleaf pines.

Methods

To capture bats, Avinet Polyester 38mm mesh bat nets set single, double, or triple high using Bat Conservation and Management Triple High Mist Net Pole System were used. Net locations were generally placed underneath closed forest canopy and across fly-way corridors such as road beds, trails, or streams. Bat calls were opportunistically recorded using two Anabat Express devices. This acoustic data was analyzed using a BCID program and helped determine best net placement for areas with high *Myotis* calls.

When bats of any species were captured, we recorded species, sex, reproductive stage, and morphometric data into a Survey123 app, which was promptly submitted into our online Heritage Trust database. Aluminum bands affixed to the forearm were mainly used on MYSE. When any Northern long-eared bat was captured, a Holohil Systems LB-2X or BD-2X radio-tag less than 5% of the body weight of the bat was affixed to a trimmed area between the scapulae using Perma-Type Surgical Cement.

Using a TR-2 Telonics receiver and folding 3-element Yagi antennae, we tracked radio-tagged bats daily for the life of the transmitter or until the unit dropped from the bat. For each identified roost, we recorded details such as tree species, diameter at breast height (dbh; inches), height of tree (feet), approx. height of roost (feet), canopy closure at roost (%), exfoliating bark on bole (%), cavities present (y/n) and decay state (1-9). We performed emergence counts at day-roosts used by radio-tracked bats to estimate colony size.

Additional assistance from staff, interns, and volunteers was provided, though anyone handling bats were required to have up-to-date pre-exposure rabies shots or titers and the necessary permits to handle MYSE.

Results

Overall

A total of 8 MYSE were captured: 2 subadults (1 male, 1 female), 3 adult males, and 3 pregnant females. The subadults, 1 adult male, and 2 pregnant females were fitted with radio transmitters and tracked to day roost sites. A total of 8 capture locations, 16 day roost sites, and 2 locations where the transmitter had been dropped were recorded (Table 1, Figures 1 - 3). Of the day roost sites, pregnant females made up half (8), the subadult female was found at 5, the subadult male at 2 (estimated locations only) and the adult male found at 1 roost.

The subadult male locations (light red text in Table 1) were approximate due to receiver

Table 1: Northern long-eared bat locations, summers of 2018 and 2019. S = subadult, A = adult, NR = Non-reproductive, P = pregnant, F = female, M = male. Locations in light red are approximate.

Date	Type	Age	Repro	Sex	Band	Frequency	Latitude	Longitude
6/5/2018	Capture	S	NR	F	A195	151.782	33.145850	-79.405410
6/6/2018	Capture	S	NR	M	None	151.741	33.145850	-79.405410
6/6/2018	Capture	A	NR	M	None	None	33.145150	-79.405260
6/6/2018	Roost	S	NR	F	A195	151.782	33.148670	-79.391910
6/7/2018	Roost	S	NR	F	A195	151.782	33.148230	-79.393830
6/8/2018	Roost	S	NR	M	None	151.741	*33.148097*	*-79.406004*
6/12/2018	Roost	S	NR	F	A195	151.782	33.148193	-79.393417
6/14/2018	Roost	S	NR	F	A195	151.782	33.148330	-79.393300
6/15/2018	Roost	S	NR	F	A195	151.782	33.148310	-79.393300
6/15/2018	Roost	S	NR	M	None	151.741	*33.153820*	*-79.406470*
4/17/2019	Capture	A	NR	M	A201	151.420	33.143440	-79.404708
4/18/2019	Roost	A	NR	M	A201	151.420	33.143990	-79.405080
4/26/2019	Dropped	A	NR	M	A201	151.420	33.152030	-79.366380
4/29/2019	Capture	A	P	F	A208	151.820	33.155087	-79.382307
4/29/2019	Capture	A	P	F	A211	151.300	33.155087	-79.382307
4/30/2019	Capture	A	P	F	A213	None	33.154904	-79.379782
4/30/2019	Roost	A	P	F	A208	151.820	33.150200	-79.390010
4/30/2019	Roost	A	P	F	A211	151.300	33.147900	-79.394490
5/1/2019	Roost	A	P	F	A208	151.820	33.150430	-79.389990
5/1/2019	Roost	A	P	F	A211	151.300	33.147480	-79.394390
5/2/2019	Capture	A	NR	M	A216	None	33.155079	-79.378861
5/2/2019	Roost	A	P	F	A208	151.820	33.153070	-79.390410
5/2/2019	Roost	A	P	F	A211	151.300	33.147900	-79.394490
5/3/2019	Roost	A	P	F	A208	151.820	33.153080	-79.390340
5/3/2019	Roost	A	P	F	A211	151.300	33.148190	-79.393034
5/7/2019	Dropped	A	P	F	A208	151.820	33.156473	-79.383357

difficulties during a rainstorm when tracking to the first location, and inaccessibility of the marsh with the second location. No roost information for these locations were collected. In addition, characteristics from 2 identified roosts of the subadult female from 6/14 - 6/15/2018 were not recorded as only the roost location was collected by a volunteer. However, these longleaf pine roosts were all in a uniform age stand within approximately 300 feet of the other 3 longleaf pine roosts with characteristics documented for the same subadult female.

The adult male utilized a cavity roost for at least 5 days before the transmitter was dropped in bottomland hardwood swamp 2.75 miles away. The cavity tree was sweetgum, had 75% canopy closure, 21.3-inch DBH, 10% exfoliating bark, was approximately 70 feet tall, had a basal cavity

opening of 6.5 inches wide by 4.5 inches tall with a cavity height of at least 3 feet. The cavity tree was 275 feet from the capture location on Sandpit Road near a pond within longleaf pine savannah.

All females roosted under bark of live, mature longleaf pine within 150 feet of a road (Figures 4 & 5), in 85-year-old stands undergoing frequent fire (approximately 2-5 years). Average female roost tree characteristics (n = 10) were 30% canopy closure, 14-inch DBH, 30% exfoliating bark, and were approximately 58 feet tall. The general understory of all longleaf pine roosts included ferns, poison oak, blackberries, and other low growing scrub.

All females were found to switch roosts daily, and distances between the previous roost varied between 5 and 1,200 feet. Only one roost tree was used twice, by a pregnant female. Emergence counts showed that all females roosted alone, with one exception of a pregnant female seen roosting with one other bat in the same tree used twice. No maternity colonies were found.

Capture locations for females were about 1 mile away from their day roosts, and capture site habitat varied greatly from that of day roosts. Females were tracked to longleaf pine roosts from captures sites in either a mixed hardwood pond area (subadult female) or closed canopy near-maritime forest (both pregnant females). We suspect capture sites were primarily foraging areas as the receiver was periodically turned on during netting, and strong signals from the subadult female and pregnant females could be heard in the netting locations we had captured them previous.

We estimate the pup season for this population to be between late April and early May, approximately one month earlier than the June 1 – July 31 pup season outlined in the current 4(d) rule. We initially captured volant (flying) juvenile Northern long-eared bats in early June 2018. Because it takes at least three weeks for the young to begin to fly, those individuals were born no later than mid-May. Finding heavily pregnant females in late April 2019 suggests pups were likely born in early May.

Swabbing for the fungus that causes White-nose Syndrome, *Pseudogymnoascus destructans* or *Pd*, was conducted in cooperation with the National Wildlife Health Center both years. In 2018, swabs for 13 tri-colored bats, 9 southeastern myotis, 1 evening bat, 1 northern long-eared bat, and 1 environmental were taken. In 2019, swabs for 12 big brown bats, 5 northern long-eared bats, 5 southeastern bats, 2 tri-colored bats and 1 environmental were taken. In addition, 15 guano pellets were collected. In 2018 and 2019, all combined wing/muzzle swabs, environmental sample, and guano pellets collected tested negative for *Pd*, the causative agent of white-nose syndrome (WNS), by real-time PCR. Note the lack of a positive result by PCR does not definitively indicate the absence of the organism. PCR may not detect the organism if it is at very low abundance in the sample.

Figure 1: Overview of Northern long-eared bat locations at Santee Coastal Reserve and WMA and Washo Reserve from 2018-2019.

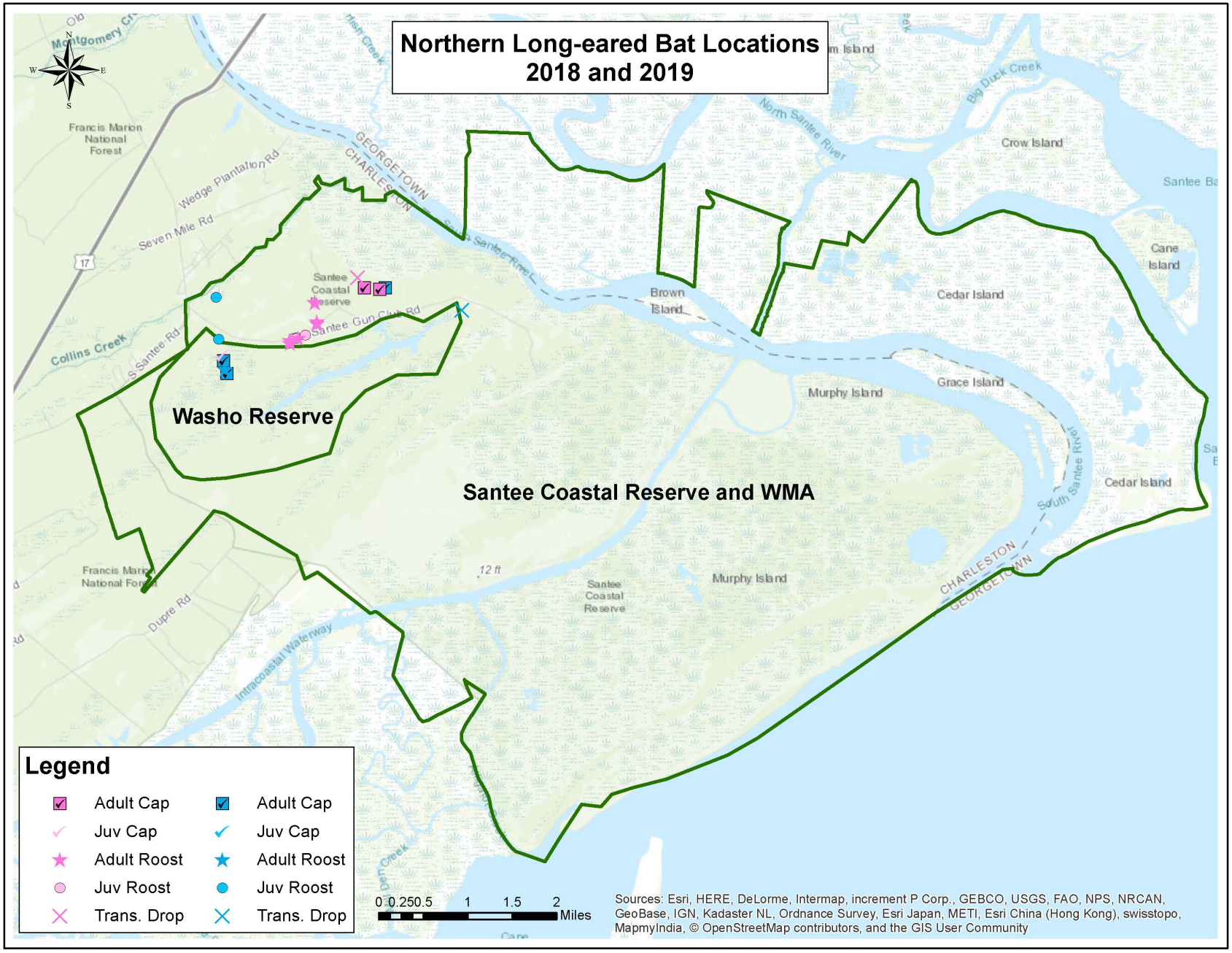


Figure 2: Topo of Northern long-eared bat locations at Santee Coastal Reserve and WMA and Washo Reserve from 2018-2019.

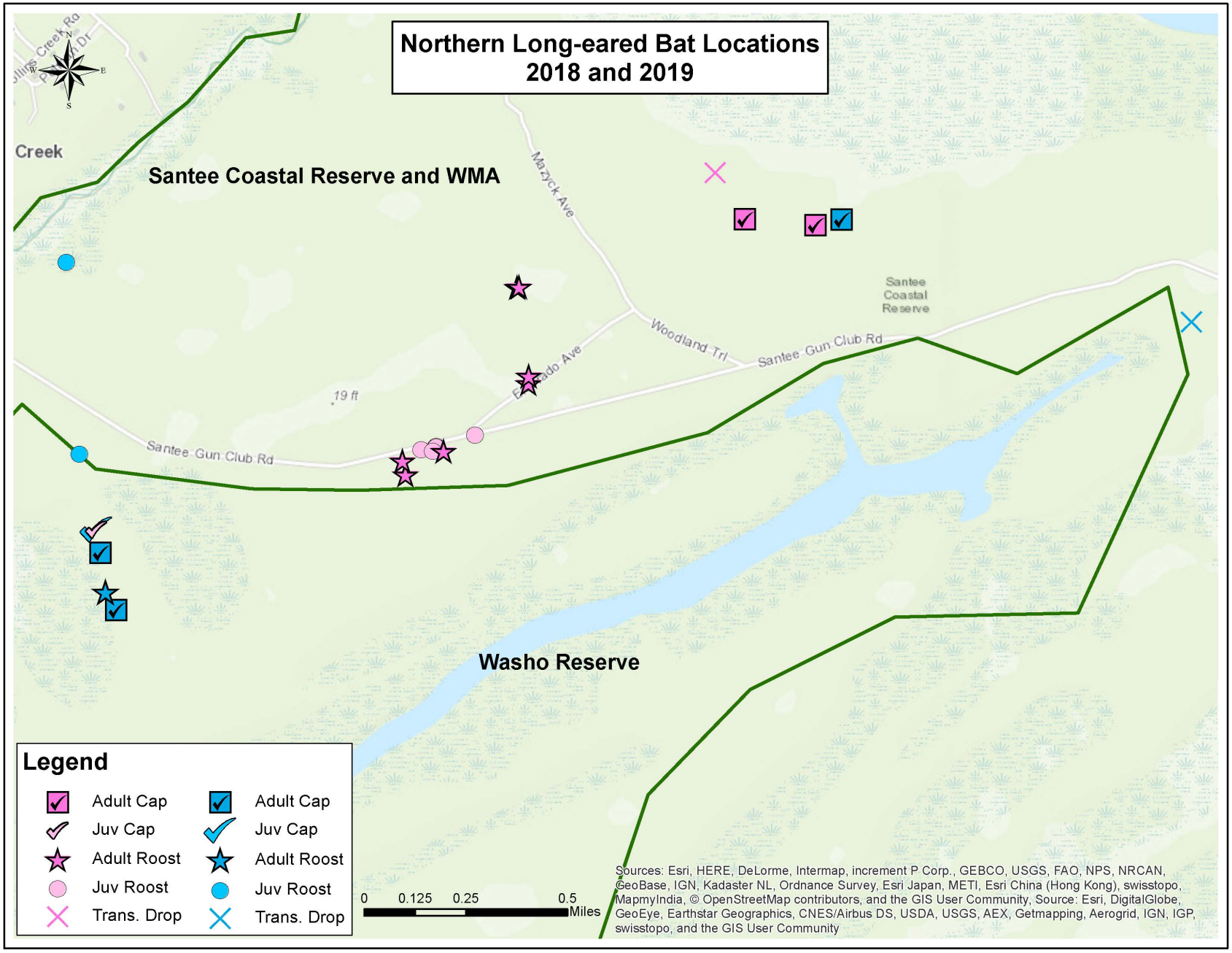


Figure 3: Imagery of Northern long-eared bat locations at Santee Coastal Reserve and WMA and Washo Reserve from 2018-2019.

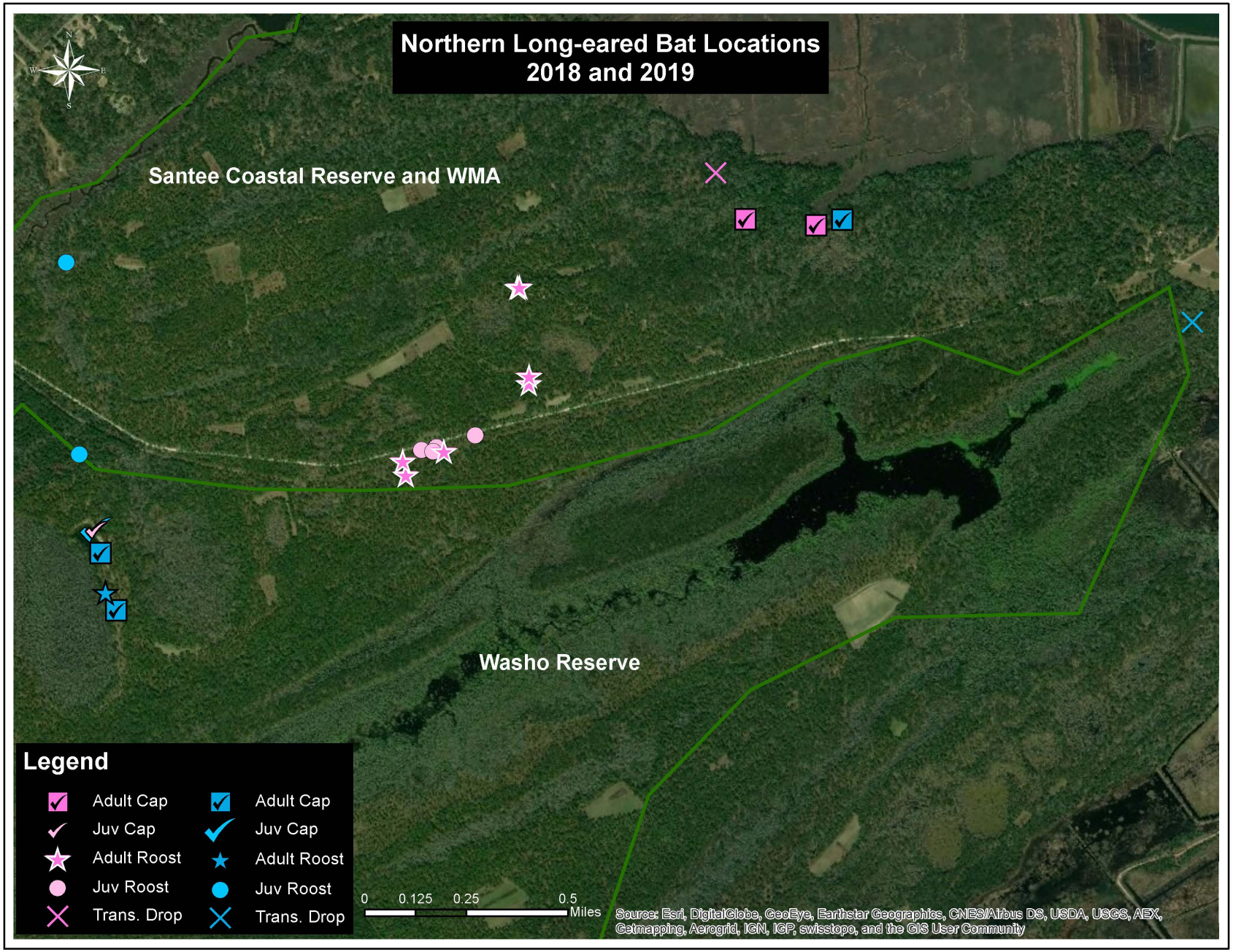


Figure 4: Imagery of female Northern long-eared bat locations at Santee Coastal Reserve and WMA and Washo Reserve from 2018-2019.

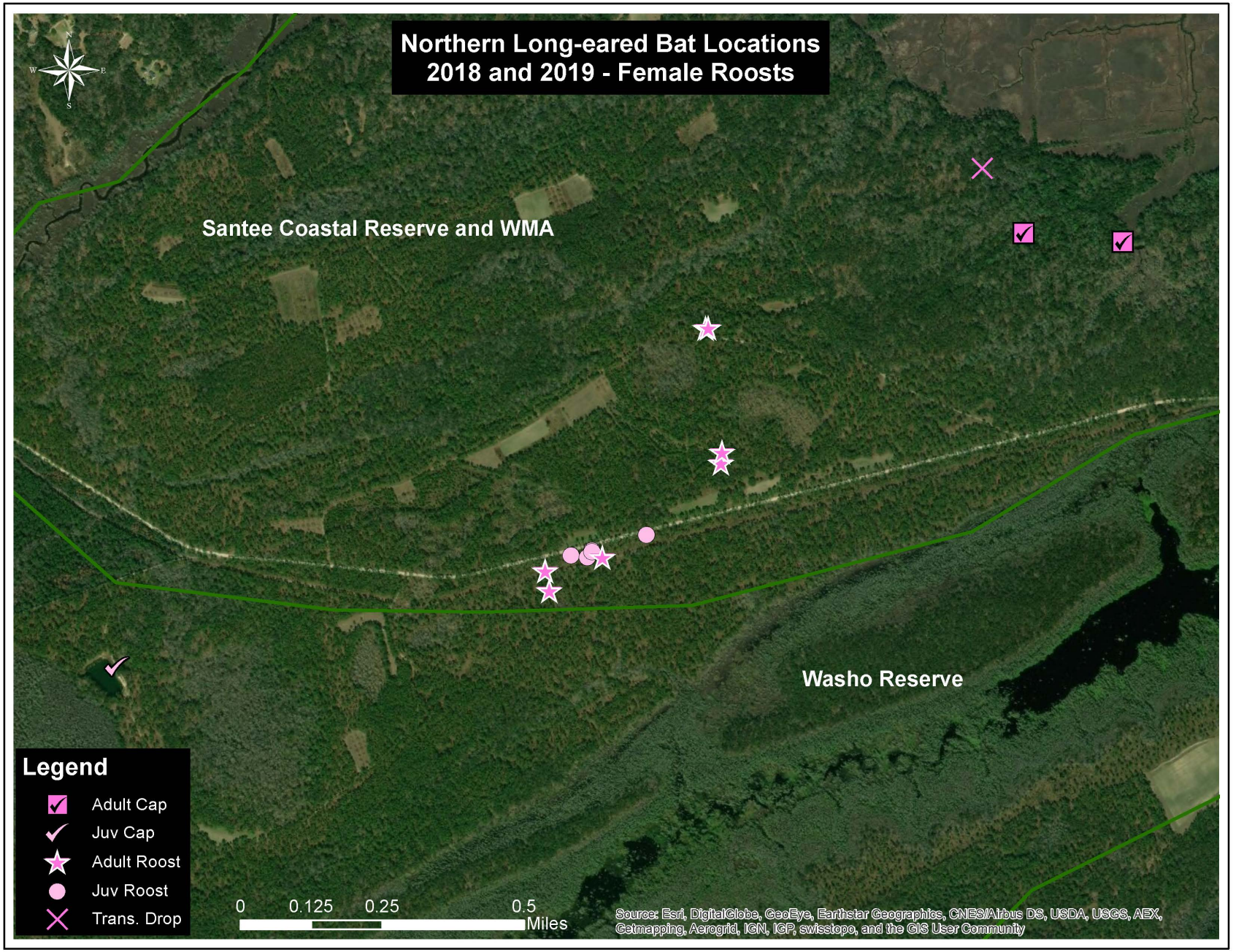
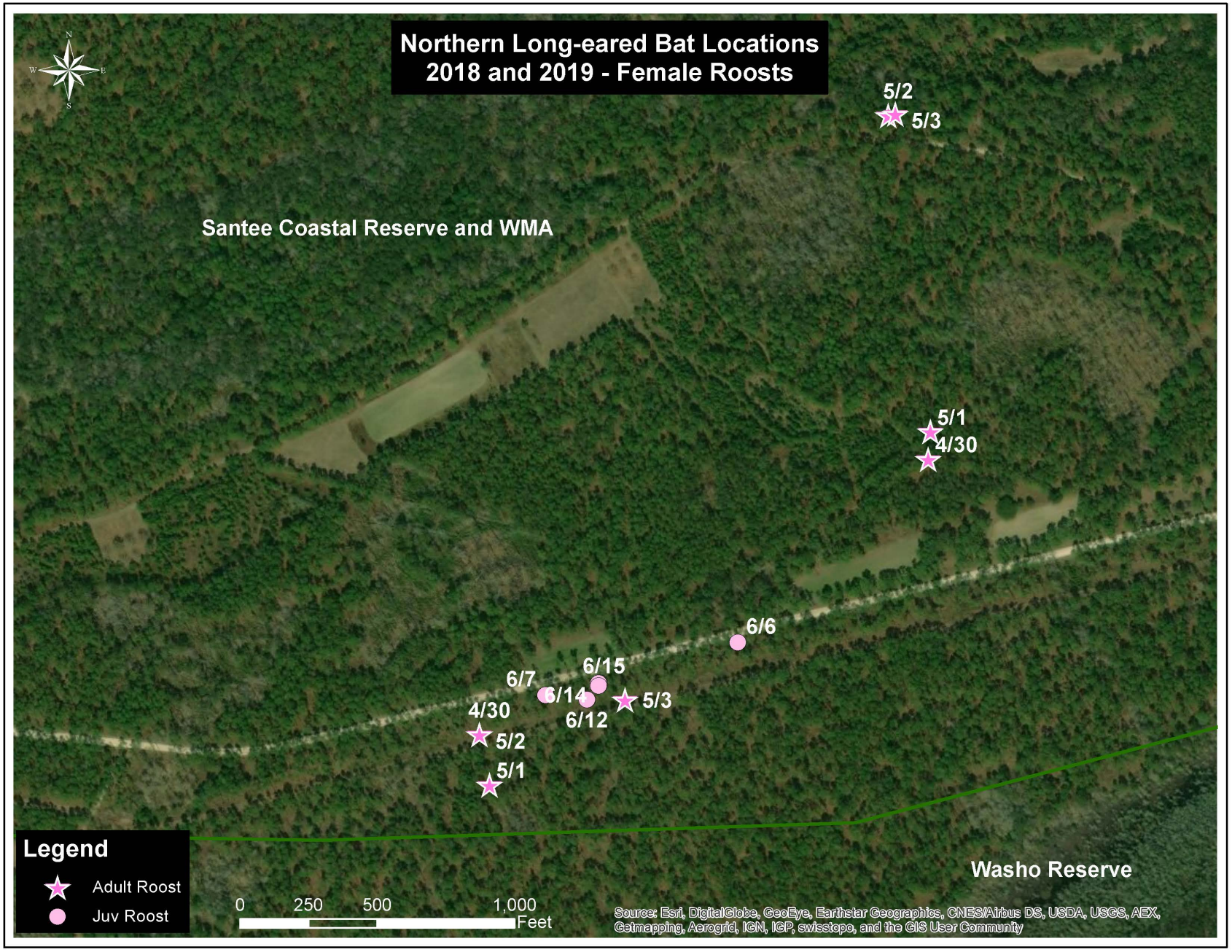


Figure 5: Imagery of female Northern long-eared bat roosts at Santee Coastal Reserve and WMA and Washo Reserve from 2018-2019.



By Individual

Subadult male, Frequency 151.741. Maps in Appendix A

Date	Type	Age	Repro	Sex	Band	Frequency	Latitude	Longitude
6/6/2018	Capture	S	NR	M	None	151.741	33.145850	-79.405410
6/8/2018	Roost	S	NR	M	None	151.741	*33.148097*	*-79.406004*
6/15/2018	Roost	S	NR	M	None	151.741	*33.153820*	*-79.406470*

We were only able to locate the sub-adult male MYSE on two occasions, 6/8 and 6/15/18. On 6/8 he was approximately 840 feet north of the capture location. The exact tree was not determined due to a rain storm, but he was likely in a long leaf pine near the edge of a small creek around 33.148097, -79.406004. On 6/15 he was located near Collins Creek approximately 3000 feet north of the capture location. We were unable to determine the exact tree he was roosting in due to swampy terrain, but it was near the point 33.15382, -79.40647.

Adult male, Frequency 151.420. Maps in Appendix B.

Date	Type	Age	Repro	Sex	Band	Frequency	Latitude	Longitude
4/17/2019	Capture	A	NR	M	A201	151.420	33.143440	-79.404708
4/18/2019	Roost	A	NR	M	A201	151.420	33.143990	-79.405080
4/26/2019	Dropped	A	NR	M	A201	151.420	33.152030	-79.366380

A single sweetgum roost with basal cavity was used from 4/18/, 4/20, 4/23, 4/24, and 4/25/19. The cavity tree species was sweetgum, it had 75% canopy closure, 21.3-inch DBH, 10% exfoliating bark, was approximately 70 feet tall, had a basal cavity opening of 6.5 inches wide by 4.5 inches tall, and a cavity height of at least 3 feet. Emergence count conducted on 4/22 showed one bat emerged from roost and left, but transmitted bat stayed until it was too dark to see. The cavity tree was 275 feet north-northwest of the capture location, which was on Sandpit Road near a Sandpit pond within longleaf pine savannah. The transmitter was found in the mud of bottomland swamp in Washo Reserve on 4/26, 2.75 miles east-northeast from the roost site.

Subadult female, Frequency 151.782. Maps in Appendix C

Date	Type	Age	Repro	Sex	Band	Frequency	Latitude	Longitude
6/5/2018	Capture	S	NR	F	A195	151.782	33.145850	-79.405410
6/6/2018	Roost	S	NR	F	A195	151.782	33.148670	-79.391910
6/7/2018	Roost	S	NR	F	A195	151.782	33.148230	-79.393830
6/12/2018	Roost	S	NR	F	A195	151.782	33.148193	-79.393417
6/14/2018	Roost	S	NR	F	A195	151.782	33.148330	-79.393300
6/15/2018	Roost	S	NR	F	A195	151.782	33.148310	-79.393300

Roosts, all under the bark of live longleaf pine, were located within 60 feet of a gravel or dirt road. All roosts were located 4,250 feet east-northeast of the capture location and within approximately 300 feet of each other in a uniform age stand of longleaf. Roost tree measurements were between 13 and 17 inches DBH, 20-25% canopy closure, 15-30% exfoliating bark and approximately 50 feet tall.

Pregnant female, Frequency 151.300. Maps in Appendix D

Date	Type	Age	Repro	Sex	Band	Frequency	Latitude	Longitude
4/29/2019	Capture	A	P	F	A211	151.300	33.155087	-79.382307
4/30/2019	Roost	A	P	F	A211	151.300	33.147900	-79.394490
5/1/2019	Roost	A	P	F	A211	151.300	33.147480	-79.394390
5/2/2019	Roost	A	P	F	A211	151.300	33.147900	-79.394490
5/3/2019	Roost	A	P	F	A211	151.300	33.148190	-79.393034

Roosts, all under the bark of live longleaf pine, were located within 150 feet of a gravel or dirt road. All roosts were approximately 1 mile southwest of the capture location and within approximately 550 feet of each other in a uniform age stand of longleaf. Roost tree measurements ranged between 14.7 and 15 inches DBH, 20-40% canopy closure, 25-30% exfoliating bark and approximately 65 feet tall.

Pregnant female, Frequency 151.820. Maps in Appendix E

Date	Type	Age	Repro	Sex	Band	Frequency	Latitude	Longitude
4/29/2019	Capture	A	P	F	A208	151.820	33.155087	-79.382307
4/30/2019	Roost	A	P	F	A208	151.820	33.150200	-79.390010
5/1/2019	Roost	A	P	F	A208	151.820	33.150430	-79.389990
5/2/2019	Roost	A	P	F	A208	151.820	33.153070	-79.390410
5/3/2019	Roost	A	P	F	A208	151.820	33.153080	-79.390340
5/7/2019	Dropped	A	P	F	A208	151.820	33.156473	-79.383357

Roosts, all under the bark of live longleaf pine, were located within 85 feet of a gravel or dirt road. Roosts on 4/30 and 5/1 were approximately 3,500 feet southwest of the capture location and 100 feet of each other in a uniform age stand of longleaf. Roosts on 5/2 and 5/3 were approximately 3,000 feet west-southwest of the capture location, 25 feet of each other in a uniform age stand of longleaf, and 1,200 feet north of the previous two roosts. Roost tree measurements ranged between 11.8 and 14.5 inches DBH, 20-60% canopy closure, 20-60% exfoliating bark and approximately 58 feet tall. The transmitter was found on 5/7 in the bark of a tree in closed canopy near-maritime forest 3,000 feet east-northeast from the previous roost site and 700 feet north-northwest of the capture location. We believe the bat pulled itself loose from the transmitter when the end of the transmitter antennae became stuck in the bark.

Discussion

These results show the first ever captures of pregnant Northern long-eared bats and characteristics of their roosts on the South Carolina Coastal Plain. Both pregnant females roosted under the bark of live, 85-year-old longleaf pine with low canopy closure and frequent fire. As can be expected, past roosting habitat of MYSE thought to only be in the mountains vary greatly from those in the coastal plain. Upstate roosts included mature mixed hardwood forest, mature Virginia pine stands, hemlock forest and mixed pine-hardwood less than 15 years old. Sadly, since WNS was first confirmed in SC in 2013, Northern long-eared bat records in the Upstate have become almost nonexistent despite similar survey efforts.

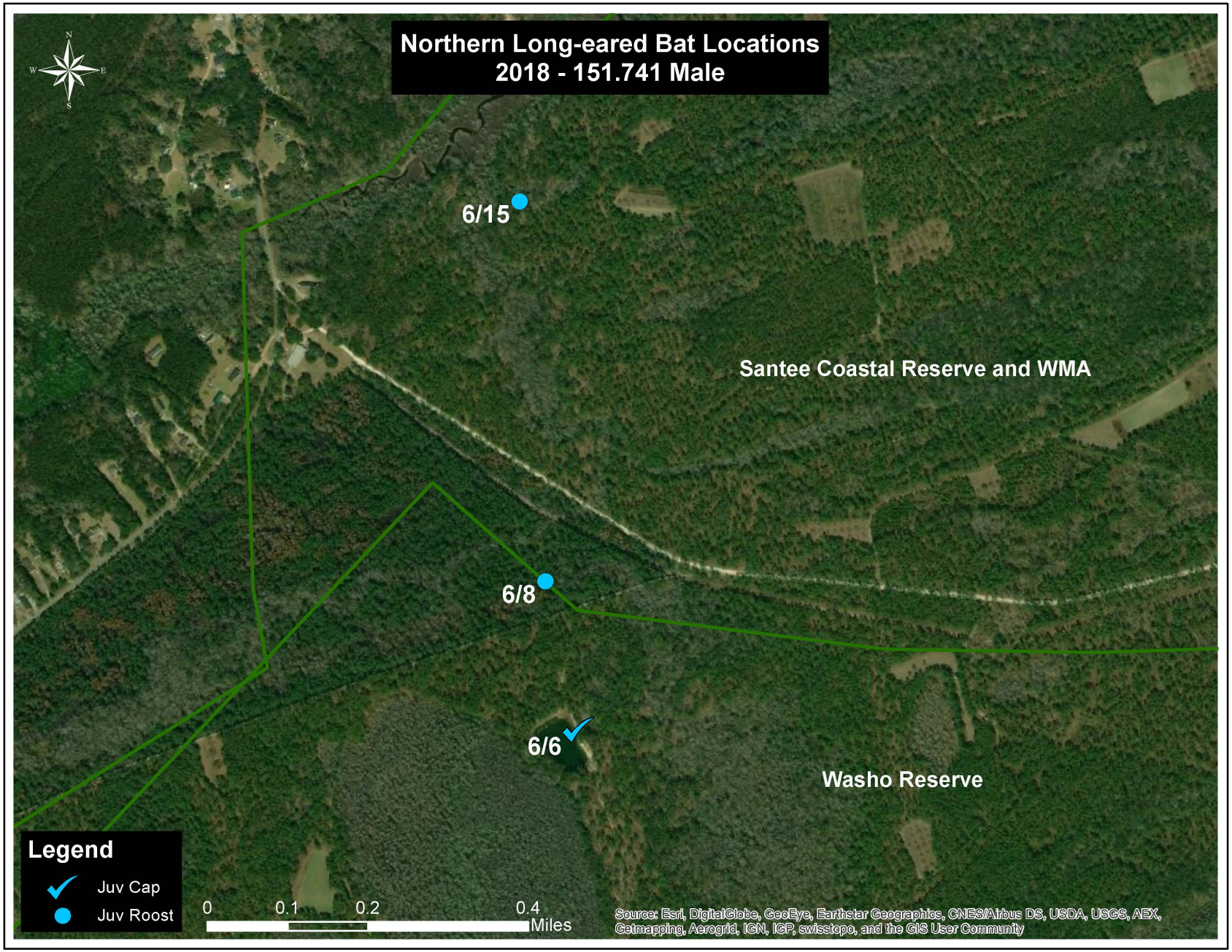
All female roosts on the property were within 150 feet of a gravel or dirt road. While it is unclear if individuals chose trees near a road, various warm sites have been known to be chosen by pregnant females to maximize growth of their pups requiring around 100 °F, and pines next to a road may be exposed to more sun. It should be noted that the subadult female in 2018 used similar roost types as the pregnant females, and her 5 roosts within 300 feet of each other were within 60 feet of a gravel road.

Though pregnant MYSE are known to form the largest colonies while pregnant, the pregnant females we tracked roosted alone or with only one other bat and no maternity colonies were recorded. However, a larger sample size may lead us to a maternity colony in the future. Biologists in North Carolina, who also captured pregnant MYSE for the first time on their coastal plain in 2019, found pregnant females roosting alone as well as in colonies.
We estimate the pup season for this population to be between late April and early May, approximately one month earlier than the June 1 – July 31 pup season outlined in the current 4(d) rule. According to the USFWS, "For the northern long-eared bat, the 4(d) rule tailors protections to areas affected by white-nose syndrome during the bat's most sensitive life stages. The rule is designed to protect the bat while minimizing regulatory requirements for landowners, land managers, government agencies and others within the species' range." We are discussing the possible inclusion of an earlier pup season in the 4(d) rule with the US Fish and Wildlife Service.

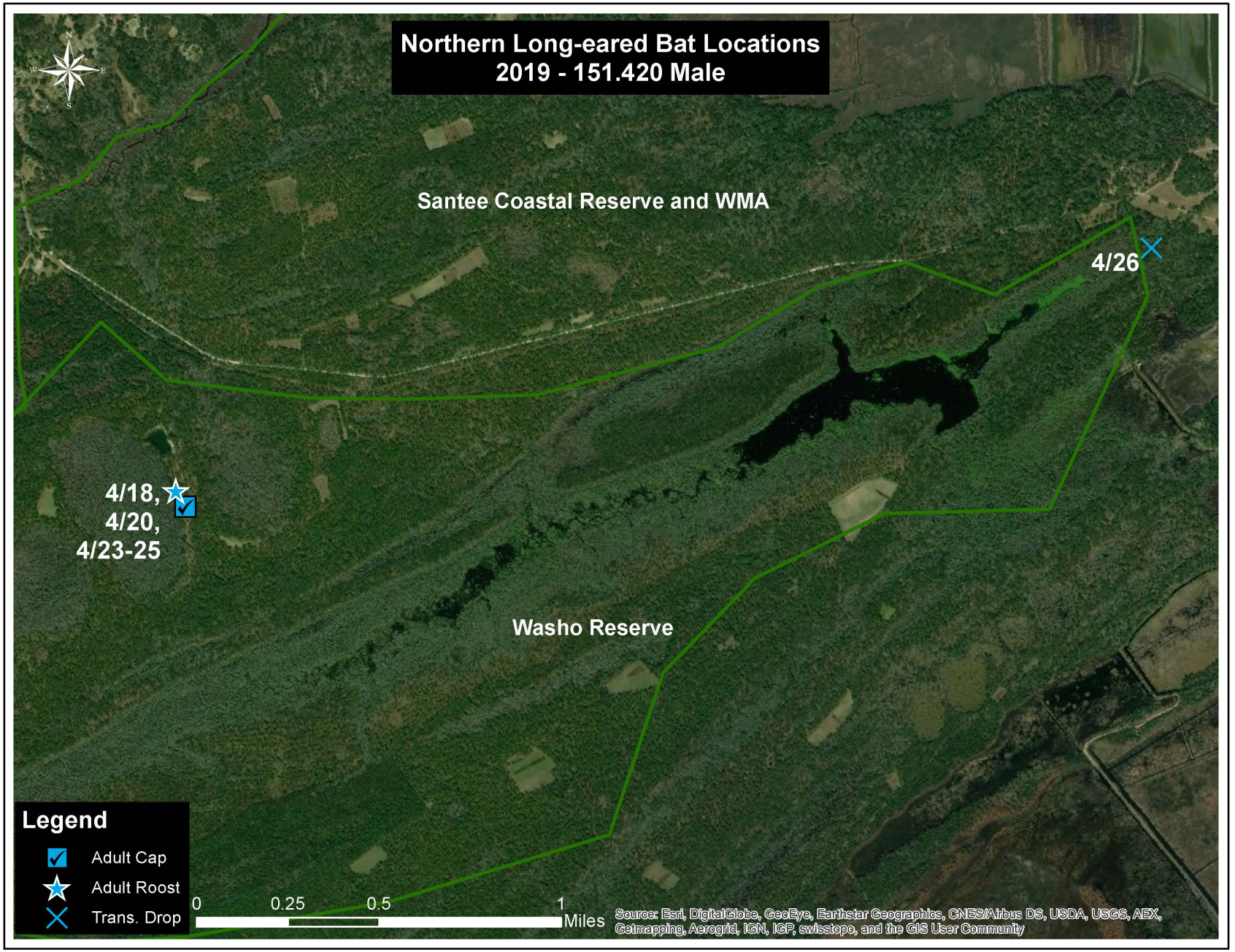
Frequent fire likely plays an important role for MYSE. Fire has beneficial effects on bat habitat as it reduces vegetative clutter, creates forest openings and snags, and potentially increases numbers of flying insects. However, the direct impacts of fire on bats and their roosts on the coastal plain, especially during the pup season, is unknown.

Negative results for *Pd* continues to be good news for bats on our coastal plain. *Pd* attacks bats while they're hibernating and causes WNS and starvation, so if populations of Northern long-eared bats can forage on South Carolina's warm coast during winter, their mortality from WNS could be greatly reduced. Understanding the extent, roost site characteristics, maternity colony locations, and timing of pups for coastal populations will help inform management for this WNS-affected species in coastal areas where they seem to be surviving thus far. As surveillance for *Pd* on our SC coast continues, we hope to provide insight into how our coastal Northern long-eared bat population is faring compared to heavily WNS-impacted northern populations.

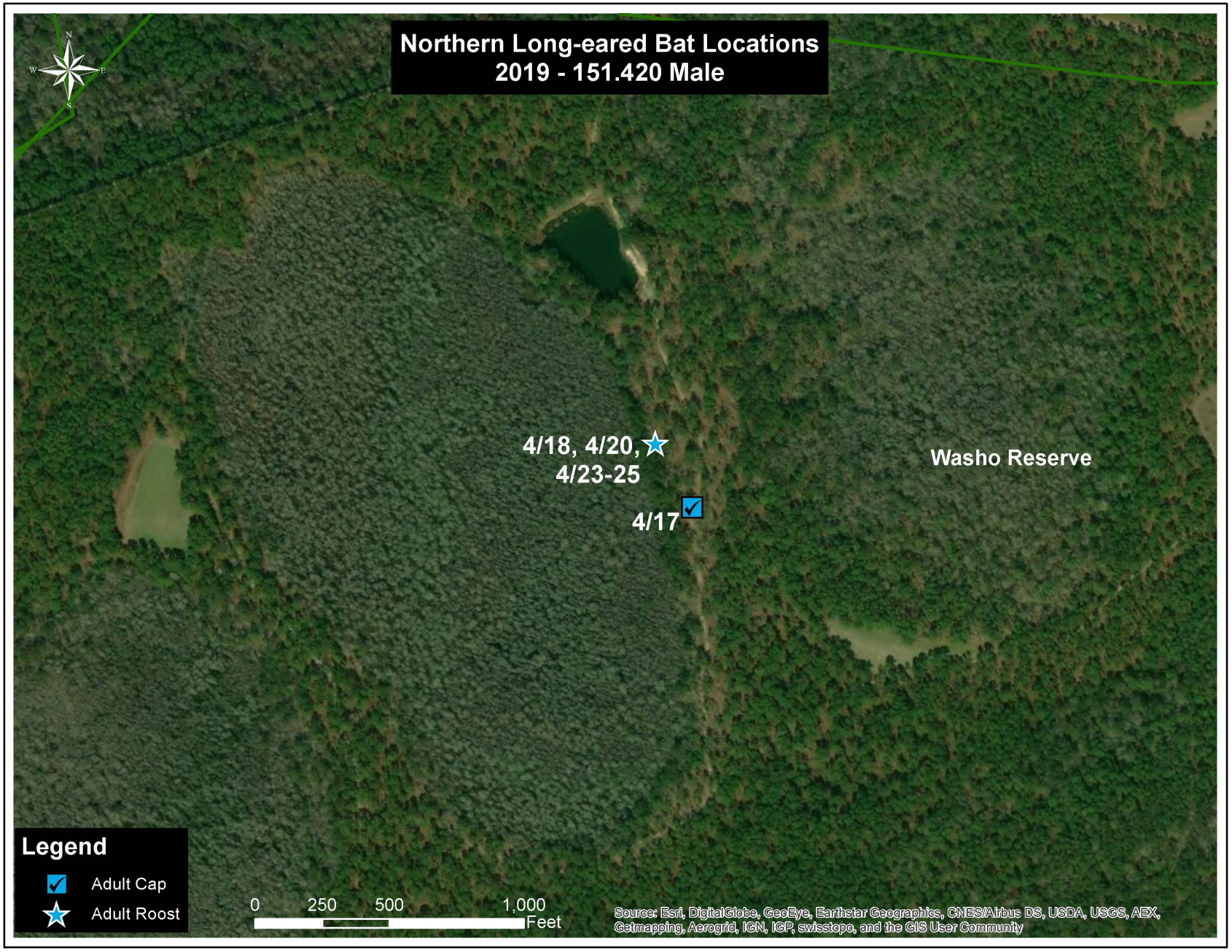
Appendix A: Locations of subadult male 151.741. Locations on 6/8 and 6/15 were approximate.



Appendix B: Locations of adult male 151.420.



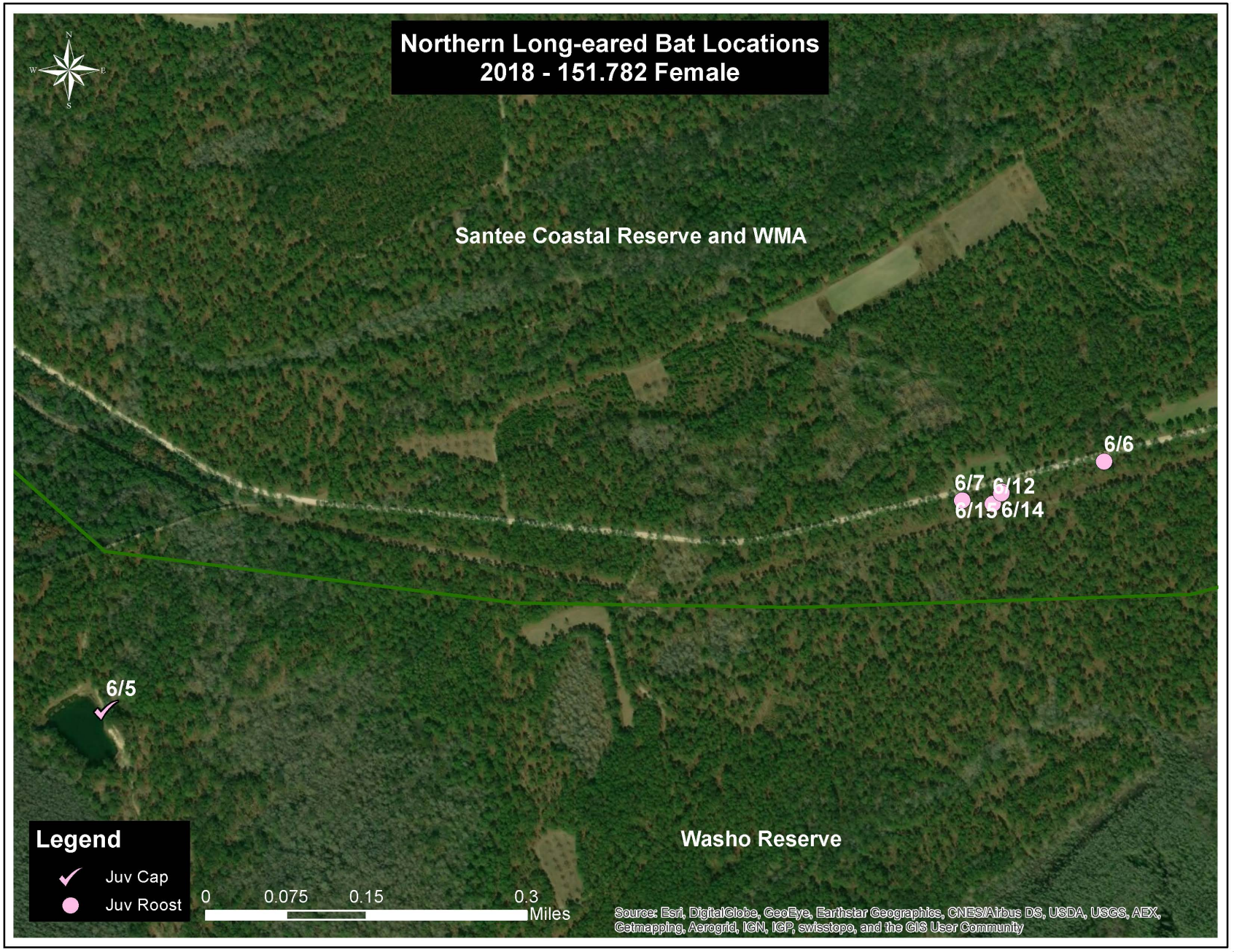
Locations of adult male 151.420 main cavity roost (blue star) and capture site.



Locations of adult male 151.420 main cavity roost (blue star) and capture site, in detail.

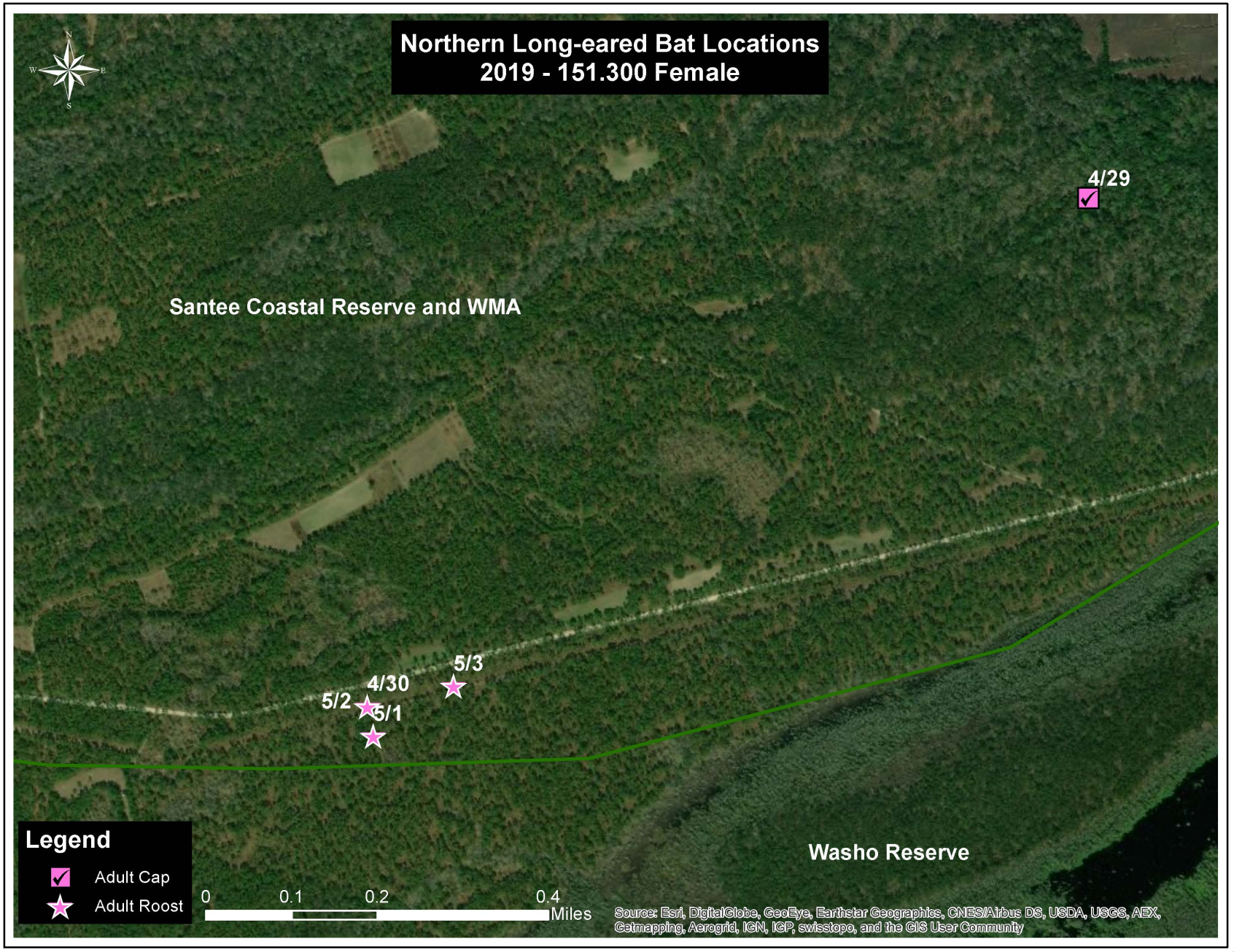
Adult male 151.420 main roost in sweetgum tree cavity.

Appendix C: Locations of subadult female 151.782.



Roosts of subadult female 151.782, in detail.

Appendix D: Locations of pregnant female 151.300.

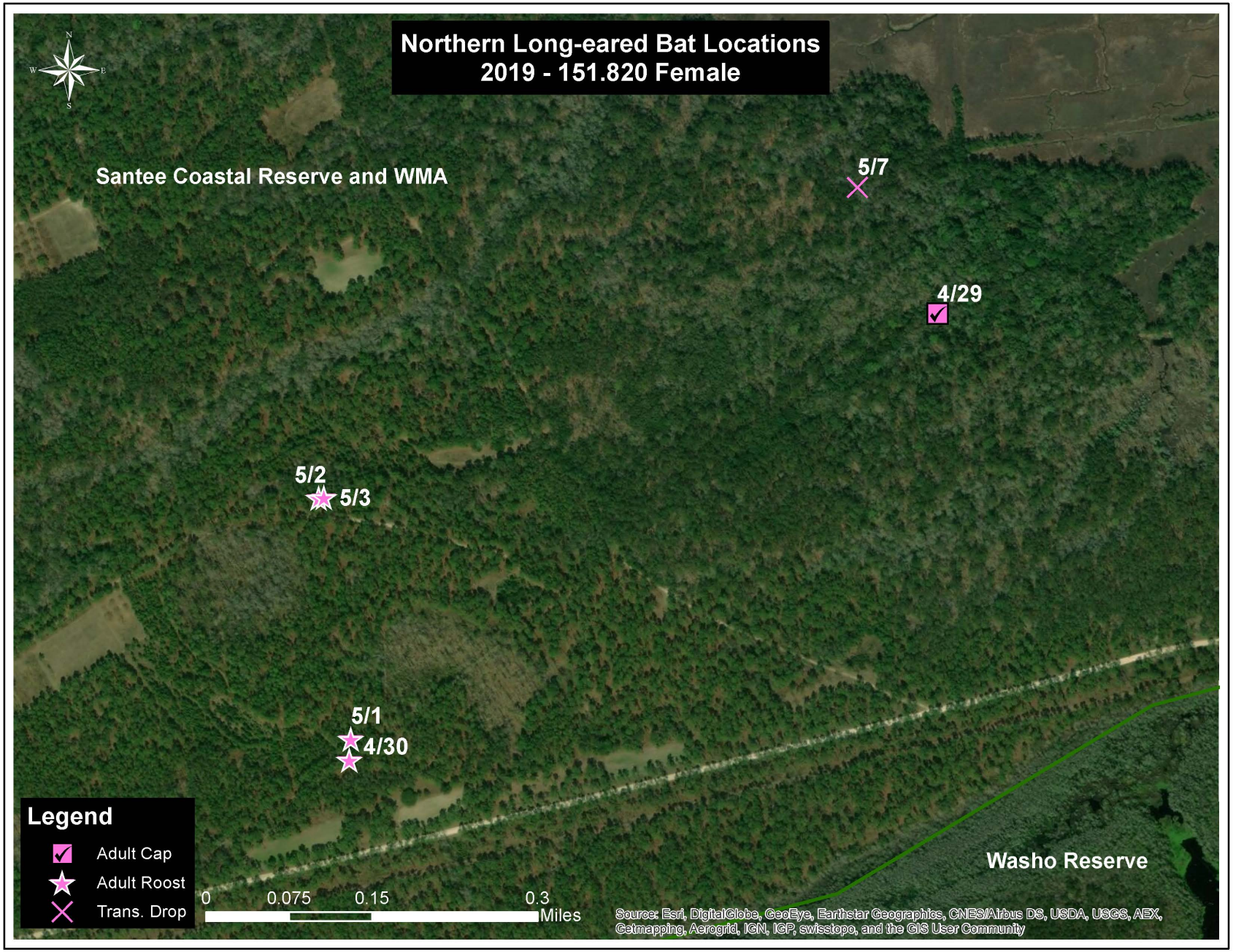


Roosts of pregnant female 151.300. Note all are within 150 feet from a road, and one roost tree was used twice.

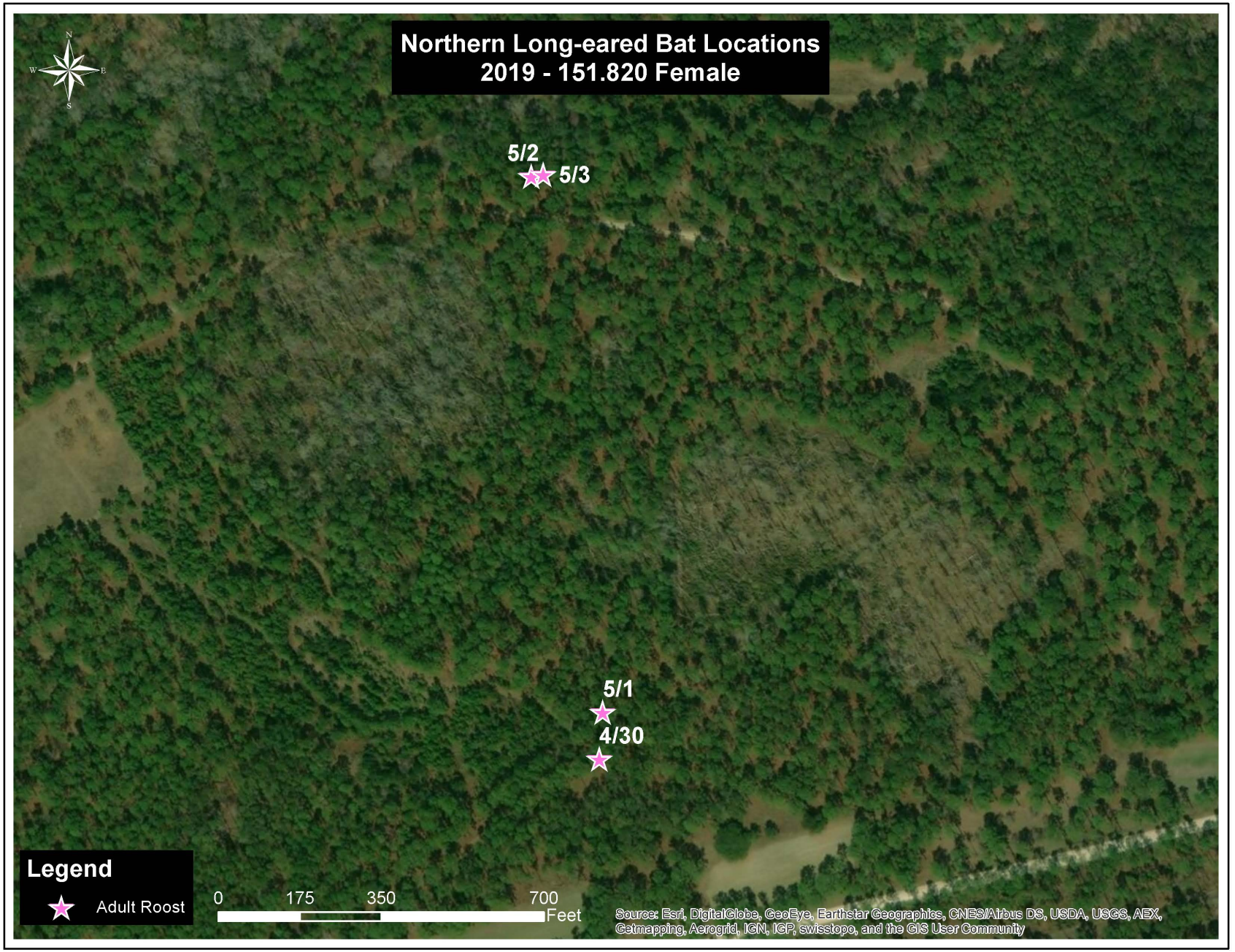
Pregnant female 151.300 roosts from 4/30 & 5/2, showing northeast side of roost.

Pregnant female 151.300 roosts from 4/30 & 5/2, facing northeast toward road.

Appendix E: Locations of pregnant female 151.820.



Roots of pregnant female 151.820.



Pregnant female 151.820 roosts to the North. Note roosts are less than 100 feet from a road.

Pregnant female 151.820 roosts, showing south side of 5/2 & 5/3 roosts.

Pregnant female 151.820 roost, looking east-southeast at 5/2 roost from 5/3 roost.

Pregnant female 151.820 roosts to the South. Note roosts are less than 100 feet from a road (which runs between them)

Pregnant female 151.820 roost from 5/1, showing northeast side of roost. Note road in the back.

Pregnant female 151.820 roost from 5/1 roost, facing southwest toward roads.